State of North Dakota
Information Technology Department

STAGEnet Infrastructure Services 2006

Post Implementation Report

Prepared by:
Dirk Huggett, PMP
Project Manager
&
Brandy Peterson
Asst. Project Manager

Table of Contents

EXECUTIVE SUMMARY

Project Identification

Project Name: STAGEnet Infrastructure Services (SIS2006) Date: 03/02/2007

Project Sponsor: Jerry Fossum Project Manager: Dirk Huggett

Background

The contract with our infrastructure provider expired in June of 2006. In order to maintain our eligibility for e-rate funds, the state is required to go to bid after each contract period. In the years during the current contract, technology has changed and the needs of the state have also increased. ITD was looking to design a network that could grow with the state's needs over the next five to seven years.

Some of the challenges the state was facing were:

- The overall network population and number of sites continue to grow.
- The network core has expanded and requires an architectural review for overall capacity.
- The demand for Virtual Private Networking (VPN) challenges the current design.
- Customer demand for bandwidth continues to grow.
- Video services continue to expand across the state.
- ATM services have been reduced with recent migrations to fiber.
- Universities have to limit Internet access due to current network costs/constraints.
- Applications are requiring increased bandwidth and lower latency (such as ConnectND and the Retirement and Investment Office's TTFR project.)
- Network security continues to demand changes and reconfigurations.
- The backbone is currently only accessible in Bismarck and Fargo while the demand for backbone access in other sites is increasing.
- Homeland security issues have brought new concerns to the network with respect to expanding disaster recovery, redundant connectivity, and possibly additional network hubs.
- IP Telephony and Voice-over IP (VoIP) is beginning to be used in state government.

In addition, the state recognized that new technologies, such as MPLS, VLANs, and Lambda (light waves) are known to be generally available and we wanted to explore how we may begin to take advantage of the new technologies. We also wanted to explore the possibilities of wireless mobility access, increased access to fiber and expansion of broadband services for smaller sights.

The customers impacted by this included all of state government, the North Dakota university system, K-12 entities, and many political subdivisions.

Summary:

We split the project into three phases.

The first phase defined the future state or vision of STAGEnet's architecture (through analysis, focus groups, vendor meetings, and other design activities) and created a procurement strategy to help us select a vendor(s) to achieve that vision. We successfully completed this phase on schedule and slightly over budget. The STAGEnet 2006 Vision Statement was the final deliverable.

The second phase was the procurement activities. This included the development, release, evaluation of the RFPs, the selection of the vendor(s) and contract negotiations. The RFPs performed as scheduled, but contract negotiations took a lot longer than expected. This impacted the schedule and timing of the next phase. Overall, this completed over schedule and under budget.

The third phase was the implementation of the chosen architecture/vendor. This phase in turn had 3 divisions. First there was design, then preparatory projects, and finally migration. A number of factors impacted this phase and it ended up over 6 months behind schedule and about $70,000 over budget. All of the cost overrun was in staffing costs related to the delay.

Overall, the project team considers the project a great success. We have a state-of-the-art network that has reduced vulnerabilities, increased bandwidth and has room for growth. The sections below provide the details, but we were able to accomplish all of the key objectives and should be able to address the identified business needs.

The following anecdote probably best describes the success of the implementation. With the legacy network, there were usually about 20 open trouble/request tickets on any given day. That was with what we considered a proven stable system. Currently the Network Operations Center (NOC) is now having days where there are only 1-5 open tickets. Considering that the full network has only been operational for less than 2 months, this fact is outstanding. Normally you would expect a higher than usual ticket counts in the first 4-6 months of a new system as you address all of the 10% (or non-standard) issues. The reduction in open issues allows the staff to focus on preventative measures and more strategic projects.

Once again North Dakota can be proud of what the state network accomplishes. State government can provide more efficient and cost effective service to the citizens. Higher Education has more bandwidth available for student services and research. K12 schools have a stable network that can meet the increased demand for video classrooms. Finally, because this project drove the carrier to provide this level of service, they can also provide it to businesses that need access to a high speed, high capacity network to succeed.

Survey: We released a Post-Project Survey to get a general sense of the satisfaction of the product and the process used in the project. Only three surveys were return so we were unable to provide any reliable statistics. In one way this is good. Generally, if people are dissatisfied they are happy to let other know. Few survey returns indicate that most people are satisfied with how the project performed. We did make sure that we accounted for all comments from those who did submit a survey.

A. PRODUCT EFFECTIVENESS

Project Results:

Phase 1:

The project produced the STAGEnet 2006 Vision Statement after conducting interviews with the Telecomm division staff and focus group meetings with both customers and vendors. We also had identified the strategy to use in phase 2, i.e. three RFPs with Transport having three sections. We completed the phase on schedule and slightly over budget.

Phase 2:

As noted above, there were three separate RFPs released with five major areas. We completed all RFPs on schedule. Contract negotiations took longer than anticipated so we completed the phase over schedule and under budget.

- **Equipment:** We needed to renew our contracts for both telecommunications and video equipment. We released this as a separate RFP. We chose to offer contracts to three vendors. They were the top three scoring vendors with a specialty vendor in each of the telecommunications and video areas and one vendor that offered both. This allows the state to choose the best prices for specific equipment and gives the state some security should one of the vendors go out of business.
- **Wireless Service:** We intended this RFP to rebid our current cell phone contract. We hoped that offering an exclusive contract would provide an incentive for vendors to offer increased high speed data services in the state. We also offered other incentives such as tower space on the Department of Transportation's towers. After reviewing the proposals, we discovered two things. First, it was apparent that our volume was not high enough to provide incentive to these national carriers to provide neither increased data services nor even anything better

than standard GSA rates for cellular services. Based on that and some less favorable contract terms proposed by the current vendor, the evaluation team decided not to award this RFP. We renewed the current contract (on which we still had extensions available) and decided that we would try another RFP the following year using the lessons we learned in this effort.

- **Transport Services:** We divided this RFP into three additional parts.
    - **Backbone:** We requested wavelength services to connect eight to ten nodes throughout the state. Even though the project team worked very hard to promote a competitive environment, DCN was the sole offer in this space. This proved to be a significant factor in some of the issues the project ran into later on. Rather than provide the requested services, DCN preferred an alternate proposal that they felt would allow them to provide additional commercial services. Negotiations took over three months. While we are happy with the design we eventually worked out, we base most of our lessons learned from the limited competition in this area.
    - **Network Access:** DCN was the only offer. There were a few key changes to the services that DCN was currently providing. First, we moved from a postalized rate to a 2 tier pricing model, recognizing that it costs more to deliver those services to the rural areas than to the metro areas. We also negotiated a technology refresh for the places where the vendor provided end point equipment, i.e. K12 e-rate locations. There was an overall increase in costs for this service.
    - **Internet Services:** This was a very successful area for the state. Sprint won this award with two changes to the service they were currently providing. First, there was a significant decrease in cost to provide the same level of service. We also added a "market" clause that should Sprint lower their rates for similar customers during the life of the contract, we would automatically be eligible for those lower rates. The second major change was the ability to collocate equipment in their Point-of-Presence (POP). This helps us to overcome a single-point-of-failure issue we had in the Bismarck/Fargo areas. The decrease in costs helps allow ITD to overcome some of the increased costs in the areas above.

Phase 3:

Phase 3 was broken into three areas as well.

- Design: This is where the architect team worked with the vendor to do the detailed design of the network. There were two major lessons we learned in this area. First, we struggled some because this was a new product our vendor was offering and they were unfamiliar with many of the design details. Secondly, we should have planned for at least six months in this area. Another significant factor that influenced this section was the constraint in buying new equipment. We only had $300,000 with a $20,000 contingency fund. This caused significant issues in the later stages of the project and made the migration much more complex and risky.
- Preparatory Projects: One of the primary reasons for this phase was because we needed to free up equipment for migration. Other activities included testing of the design, facility and site preparation, and the vendor's core infrastructure installation. We originally planned this as three months of work. Several key factors impacted this part of the project. First and most significant, the vendor had a difficult time obtaining critical components for the backbone infrastructure. The original schedule had them turning over the network to us in early June. We did not actually get it until the end of August. This had a significant impact to the overall project and caused most of the cost overruns. Unfortunately, we also discovered that the vendor had very poor project management skills at the same time. This caused us to have to completely remap the migration plan several times. This is where the complexity caused by the reuse of equipment impacted the project team. Making adjustments to the migration plan wasn't just a matter of moving one activity somewhere else. Many activities were dependant upon a previous activity freeing up a particular piece of equipment. One other issue we had

with the vendor regarding their lack of project management methodology related to the fact they were building a new facility in Fargo. Our space in the new facility was supposed to be available to us by late May. We didn't have our cabinets for equipment until mid-July and there was no permanent power to that area until mid September. We had to use some unorthodox work-arounds to come close to completing our activities. With that said, we underestimated the amount of time it would take for us to perform some of the tasks planned in this section. While it is very unlikely we could have made the early June timeline originally planned, if it wasn't for the vendor issues noted above, we could have made an early to mid July timeline. One other note for this section. Due to a misunderstanding of the contract, we misconfigured a number of routes. This relates to how the vendor and its partners tie certain sites to certain cities rather than a pure logical quadrant basis. Overall, we completed this phase over schedule and under budget.

- Migration: It was our original goal to migrate to the new network over the summer for two reasons. First our contract expired June 30th and so we wanted to make the cutover to the new contract terms and clean as possible. Next, this would have the least impact to two of our key customer groups; K12 and Higher Education. Unfortunately, due to the vendor issues noted above, we had to replan for a late July/August timeline and then again for a fall rollout while school was in session. This significantly impacted the schedule because now we had to accommodate critical school processes into our plan. In addition, the reuse of equipment not only increased the complexity as noted above, but it also increased our risk in the sense that our ability to back out of a change was limited and we quickly reached a point that a complete back out to the legacy system (in case the backbone became unstable) was impossible. Unfortunately, our only choice was to accept this risk and hope it didn't occur. The first task planned in migration was testing. We quickly discovered that the core was not set up as expected and so, again we delayed the project. Migration finally started at the end of September. We then found the core was unstable. Since we had only migrated the first area, we were able to back out of the migration. Once the core stabilized, we moved forward with the migration, pushing the schedule out as needed. Aside for some minor adjustments to overcome some business concerns regarding the timing of the K12 and Higher Education, the rest of the project deployed as planned. K12 was the only customer who experienced any major issues during the migration and we addressed most of those by the end of the following week. The project completed on December 23rd, on schedule and over budget. All budget overruns were "soft dollar" staffing costs.

You can find details regarding Cost, Scope, Schedule and Quality in the Project Metrics section of this document.

Satisfaction of Identified Business Needs:

The project identified the items below as some of the challenges the state was facing. How the project addressed the need follows each identified need.

- The backbone is currently only accessible in Bismarck and Fargo while the demand for backbone access in other sites is increasing.
  - The project took us from two hub cities to four, adding Grand Forks and Minot. The system has the capability to expand to Williston, Dickenson, Devils Lake and Jamestown should the need or security demands justify the additional costs.
- The network core has expanded and requires an architectural review for overall capacity.
  - The legacy core architecture was reaching capacity levels. Just by expanding the core infrastructure to four sites we cut the workload at the two original hubs almost in half. We were able to do this with a minimum of equipment purchases, extending the life of much of our current equipment (although this caused us some problems.) We were also able to apply some lessons learned from the legacy network that we were unable to address previously.
- Homeland security issues have brought new concerns to the network with respect to expanding disaster recovery, redundant connectivity, and possibly additional network hubs.

- The project gave us direct access in the Sprint Point-of-Presence (POP) facilities improving our disaster recovery options. This gives the state the ability to still access the data center even if we lost the Bismarck hub. In addition, we can now separate much of the state into quadrants giving us the ability to isolate problem area more narrowly. It also allows us to apply maintenance without taking out over half of the entire network. We have already had a successful "test" of the redundancy. Someone decided to use a post for target practice. The post happened to be one of the vendor's pedestals. The effect was a break in our core ring between Minot and Grand Forks. Our system automatically rerouted all traffic and our customers never felt an impact.

• Network security continues to demand changes and reconfigurations.
- The new network gives the ITD staff more flexibility to configure the system then the legacy system allowed. In addition ITD designed the system to provide additional security that was not available in the legacy system. We now have physical separation between the key customers. This helps us keep a problem in one area from spilling over into another.

• The overall network population and number of sites continue to grow.
- The additional hubs help address this concern as mentioned above regarding the congestion. In addition, in many cases it reduces the "last mile" length. However, due to the way our vendor and its partners are connected, we did end up with some unusual links such as Bottineau connecting to Bismarck instead of Minot. The expanded bandwidth also addresses this issue. We could use the 4th gigabit port if expansion is necessary. Additional ports can be added to the system should demand justify the cost.

• The demand for Virtual Private Networking (VPN) challenges the current design.
- We have overcome most of the challenges we were facing.

• ATM services have been reduced with recent migrations to fiber.
- The new contract reset the ATM service floor limit allowing us to take advantage of some of the new fiber optics that is available.

• Universities have to limit Internet access due to current network costs/constraints.
- We were able to remove several legacy system bottlenecks allowing the University System to improve the bandwidth at all schools. The four Higher Ed facilities located in the hub cities saw a significant improvement on bandwidth available. Grand Forks was a particular success in this. There was only one fiber line into the university and the cost of increasing the bandwidth using the legacy technology was prohibitive. Now a second fiber line provides secure redundancy. There is 1 gigabit access to the carrier's POP using equipment collocated at the university. This allows the university to provide better service to the students and researchers. In addition, shared applications, like ConnectND, show improved network performance. More details about this are available below. A good recent example of success was our ability to connect a new business in one of the incubator parks to the internet. On the new network it was a fairly simple matter of some programming and we could meet their needs without compromising our network's integrity. This would not have been possible in the legacy network

• Applications are requiring increased bandwidth and lower latency (such as ConnectND and the Retirement and Investment Office's TTFR project.)
- The new system has significant improvements in both bandwidth and latency. For example, with ConnectND we now have a more stable connection with improved bandwidth. We were able to eliminate some equipment helping to reduce some lag, and have a much better failover capability than we had with the legacy system.

• Customer demand for bandwidth continues to grow.
- The legacy system did not provide for any specified bandwidth guarantees. Our traffic was running on public infrastructure. The new network provides 1GB bandwidth for each of the three main segments of our core between the 4 hub cities. As noted above, it is fairly easy to add additional 1GB connections into the system if we can justify the additional cost.

- Video services continue to expand across the state.
  - Again, the increased bandwidth, improved latency, increased separation of traffic has put us in a better position to support the increased video demands.
- IP Telephony and Voice-over IP (VoIP) is beginning to be used in state government.
  - The same things allow us to support this initiative as well.

Some other benefits that we were able to achieve during the project are as follows:

- We are in a better position to support the Northern Tier network.
- We have a 4th ring available to us. There are many possibilities for its use and discussion is on-going. Possibilities include: dedicated (HE) research, I2 traffic, an external network, or a experimental test network.

B. CSSQ MANAGEMENT

We used an integrated control process. We handled changes, issues, and risks in a similar manner. This worked quite well because we had a fairly intimate group of people controlling the project. We managed the schedule using MS Project and all other management tools were in a single MS Excel workbook. This was stored on a shared drive that all team members could access.

We had a total of seven change requests/impact statements over the course of the project. Four occurred in phase 2 and three occurred in phase 3.

- The first change pushed the release of the wireless RFP by four days and eliminated the bidders' conference. The first item was to give the team a little more time for final review and adjustments to the RFP and we based the second item off a lesson learned from an earlier released RFP. **Overall Impact:** We made up the days by removing them from the response time the vendors had available to them. We felt that nine weeks was still an adequate amount of time for them to respond. It also impacted a payment milestone with our contractor, but they were in support of the change.
- The 2nd change also dealt with schedule & scope changes. Only one vendor bid on two parts of the Transport RFP. They also proposed an alternate solution. We had to submit an alternate procurement form for the sole sourcing of the solution. We were able to enter into negotiations with the vendor four weeks ahead of schedule; however, the solution proposed would entail a significant cost increase. We left the planned contract signing date as is, but recognized the risk of not being able to meet that deadline. In addition, the 3rd part of the Transport RFP had to go out for best-and-finals. This pushed that portion of the schedule out by a week. **Overall Impact:** With the contractor's approval, we shifted a payment point to the new deadlines. We recognized the new risk and the possibility that we might have to adjust the desired scope.
- The 3rd change adjusted the budget downward due to a reduction of travel with the new contract brought onto the team. **Overall Impact:** A reduction in cost of $16,500.
- The 4th change eliminated the 3rd phase of the project. This change was later rescinded.
- The 5th change extended the design section of Phase 3 by one week to account for the loss of a key staff member. We mitigated the shift by shortening the Preparatory Projects section by a week. **Overall Impact:** Due to the vendor's struggles obtaining the needed parts, we ended up extending the Preparatory Projects Phase by almost 3 months; so this change had ultimately no impact to the project.
- The 6th change addressed the vendor delays in the backbone, their Fargo facility and the inability of the vendor to get the redundant fiber path installed in Grand Forks. **Overall Impact:** This was the most significant change to the project. It changed the budget by almost $65,000 in staffing costs and pushed the schedule 15 weeks.
- The 7th change addressed the failure of the ring and the fact we needed to back out of the migration. It also addressed the concerns Higher Ed had with the timing of their portion of

the project. **Overall Impact:** This increased the approximate end date by 3 weeks and added about $26,000 in staffing costs.

Overall, the processes used worked well with this project. We addressed and communicated the changes in a timely manner.

C. RISK MANAGEMENT

We performed a limited level of risk management in this project. There wasn't a lot of risks identified in the planning process. One of them we did identify was the contract deadlines.

The Equipment contracts needed to be signed by 31 Dec 2005 because the current contracts expired 01 Jan 06. On the equipment side, the contract that took some time was the Qwest contract. There were issues with the state's terms and conditions. The state had been working with Qwest on another contract for over 6 months. We were able to use that as a basis and were able to eventually worked things out. Also, there were some issues with the insurance certificate from Corporate Technologies, but we received it in time. The DCN contract required a lot of negotiating and number crunching. The initial thought was that a contract needed to be signed by 31 Dec 05, but we found out that was not the case. The extended negotiations did impact the project. Since negotiations included what we were to ultimately buy, network design had to wait until things were locked down.

We did identify some additional risks during the project and came up with strategies to address them.

- Consultant changed personnel: A risk that came up during that project was the Federal Engineering consultant that we started with took another job offer just before the team started to work on the RFPs. The new consultant came in a day before the current one left and we felt that we did not get sufficient notice from Federal Engineering that there was going to be this change. Fortunately with the ITD project team that was in place we were able to keep things on track. There were a couple of issues with the new consultant that we were forced to deal with, i.e. the lack of willingness to travel by the new consultant and the fact that the new was more technical person than a writer, which we felt we needed more. Eventually the consultant brought in an additional person who was able to fill in the gaps. Since we had signed a fixed price contract, the only costs were the additional travel expenses and we mitigated those with less overall travel.
- Wireless contract extension: When the evaluation team determined that the best choice in the wireless RFP was to just extend the current contract, there was some risk involved that we had the possibility of Alltel not wanting to extend the contract. But they worked quickly with the procurement office and we were able to get the extension in time.
- Red River Flooding: This is always a concern in the spring for this area. The project had some critical projects going on in that area including the completion of the vendor's Fargo site and some key fiber connections. With this, all we could do was mitigate. We developed contingency plans to adapt the schedule to anticipated delays caused by the flood. Even though there was some flooding in the area, it was minor and delays became moot due to other delays with the vendor.
- Vendor having quality issues with new equipment being deployed: We were concerned that part of the reason our vendor couldn't get the parts they needed was that the manufacturer was having difficulty getting the product to pass quality tests. To mitigate the issue, we added another week of testing to the plan.
- Architect is out of office for next 3 weeks: We did not identify this earlier because we were supposed to have the project completed by that point. But with the vendor delays, it came into play. The architect was also the senior manager for many of the people on the project. Other managers picked up the slack and the Architect stayed in almost daily contact with the team via phone and e-mail.

In general, this area was pretty weak. It worked OK for the project, but we could have done much more.

D. COMMUNICATIONS MANAGEMENT

Communications was an important part of this project. Stakeholders were brought in (during phase 1) to help identify needs and then confirm that the vision met those needs.

Additionally, a project website was available to all stakeholders where status reports, presentations and much of the technical documentation were available on the site. We also ran the RFPs off this site. This was probably one of the most important communication tools.

The project team met weekly. The vendors attended this on a regular basis.

We produced biweekly status reports.

In Phase 3, one of the best communications we did was a monthly IVN session with our customers. This provided them the opportunity to find out the status of things first hand and ask questions.

We held Executive Steering Committee (ESC) meetings quarterly. Generally, we presented the quarterly Large Project Oversight report to them.

We processed outage notifications in the normal manner. We did increase our communication level with Higher Ed somewhat during Phase 3.

We were supposed to be able to use the Federal Engineering (FE) web tool FE Client Net, in phases 1 & 2. But it was never kept up to date by FE and ITD just started to use the STAGEnet website as a communications tool for the stakeholders.

Throughout the project it was also difficult to receive FE's status reports in a timely manner, towards the end of Phase 2, it did get better.

Towards the end of the project, the Network Architect produced some summary updates that were distributed via the Service Desk. These were very effective status updates and it was an effective communications method.

E. ACCEPTANCE MANAGEMENT

We had an effective acceptance management process throughout Phases 1 & 2 where we had clearly identified deliverables (specific documents). We connected many of the vendor payments with acceptance of the deliverable.

However, we did not establish those defined deliverables for Phase 3. There were a couple of reasons for this. The people performing the deliverable were the only ones who could identify the quality level of the deliverable. In addition, the senior telecommunications staff were performing or controlling most of the deliverables. The sponsor was generally comfortable with the weekly team meetings and biweekly status reports to monitor the completion of tasks.

This worked fine for this project, but would likely not work for most projects. We definitely should have identified key vendor deliverables and had formal sign-off on those.

F. ORGANIZATIONAL CHANGE MANAGEMENT

For most stakeholders, this change was transparent. They should have noticed no difference in their service and duties. Some IP addresses had to be changed in the K12 area and the team worked closely with the K12 contacts to ensure the necessary changes occurred. Again, this impacted only a small number of people. Most K12 stakeholders saw none of the changes.

In the telecommunications division, things did change some. However, many people across the organization were involved in the design. We communicated the design throughout the organization. We organized teams including members of the architect group, Network Operations (NOC), and Facilities to do the detailed layout. We also had a mixed group build a test lab and perform testing.

These groups also worked closely together during the migration to the new network. In general, most of the people impacted by the change were involved somewhere in the design, testing or implementation.

We feel this was a successful method of handling change management.

G. ISSUES MANAGEMENT

We used a typical integrated change control process to manage issues. Overall, issues that were team related used this process and we managed them well. Unfortunately, issues with the vendor were not as successful.

The fact that the vendor did not employ effective project management for its own project was the primary cause for this failure. In addition, due to the monopolistic hold on the infrastructure we were not able to put any teeth into the implementation portion of the contract. The vendor missed every major milestone they gave to us. We identified those issues and brought them to management's attention, but we were never able to influence or even get a revised date that we felt confident the vendor would meet.

The table below describes several key issues and their resolutions. You can find the full list on the Controls spreadsheet.

Issue #	Issue	Date Reported	Date Resolved	Resolution
2	Staff is recording meeting hours spent on the project, but most are not recording hours actually doing project work. This impacts our performance indexes which gives us an inaccurate Estimate at Completion.	3/28/2006	3/31/2006	Dirk received location of spreadsheet that other staff will track hours to. Linked it to budget xls.
5	Vendor Equipment Delay - DCN is now reporting that there could be a delay in their equipment delivery, which could push back the delivery timeline of the backbone for 4-6 weeks.	04/11/06	07/14/06	7/28: The migration phase has been adjusted to fit the new start timeline. 7/14: DCN now has the needed equipment. 6/16: DCN still hasn't recieved the promised product. Push looks like now Aug 18 or the 25th. 5/26: Slipped another week to August 11. 5/19: Looks like new slip date is August 4 before we get the ring turned over to us for production. 5/5: Vendor has warned that supplier is trying to slip the date another 3-4 weeks. This could have a major impact on the project. 4/21: Follow risk guidelines and come up with alternative

				implementation plans
7	DCN is unable to supply power to the Fargo location.	07/07/06	09/16/06	9/22: Finished on 9/16 weekend 9/8: Permanent power available. Scheduled for completion the weekend of 9/16. 8/25: Workarounds have been established until permanent power can be installed. Still no word on when that will occur. 7/14: The original plan had the Fargo DCN facility available to us by the end of May. The delay was not escalated as that task was not on the critical path. It has now entered the critical path and it appears we may not have full access until mid-August. This prevents us from completing any pre-migration work and could now further delay implementation. We are escalating the issue to DCN management.

H. PROJECT IMPLEMENTATION AND TRANSITION

As noted in the organization change management section, many of the people responsible for the on-going support of the new network was involved with the design, test, and/or implementation. This allowed us to transition to operational mode with virtually no issues.

I. PERFORMANCE OF PERFORMING ORGANIZATION

Most of the telecommunications division was fully involved with project. They performed extraordinarily well. Due to the shift of the schedule outside of the summer timeframe originally planned, most of the transitions had to take place late at night/early in the morning. Many staff members had to put in significant amounts of overtime, often while traveling. On the rare occasions when staff performance did become an issue, it was handled by the regular management team in a quick and professional manner.

Performance of vendors is an entirely different story. In phase 1 and 2, we struggled with the vendor's general reporting timeliness and then the vendor did not handle a staffing change very well. Again, the ITD project team responded positively communicated with the vendor regarding the dissatisfaction of the situations and were able to resolve the issues quickly or support the project with their own talents.

We discussed the performance issues with the phase 3 vendor in the Issues section of this document.

J. PERFORMANCE OF PROJECT TEAM

The project team performed extremely well. At times there was resistance to some of the project management processes, but everyone always behaved professionally and were willing to work through any issues. People were fully engaged throughout the project. Everyone worked well together and did what they could to minimize any negative impacts to any other group. This was truly a positive, well focused, and dedicated team of people. Everyone gave 110%.

K. KEY PROJECT METRICS

COST

	Original Budget	Revised Budget	Actual Costs	Difference from Original	%	Difference from Revised	%
Hard Dollar							
FE	$382,720	NA	$382,720	$-	0%	NA	NA
FE Travel	$48,560	NA	$46,468	$(2,092)	-4%	NA	NA
Equipment	$300,000	NA	$303,146	$3,146	1%	NA	NA
Staff Travel	$10,000	NA	$8,060	$(1,940)	-19%	NA	NA
PM	$55,401	NA	$34,448	$(20,952)	-38%	NA	NA
Contingency	$9,757	NA	$-	$(9,757)	-100%	NA	NA
Subtotal	**$806,438**	**$806,438**	**$774,842**	**$(31,595)**	**-4%**	**NA**	**NA**
Soft Dollar							
Staffing	$286,468	$376,948	$294,606	$8,138	3%	$(82,342)	-22%
TOTALS	**$1,092,906**	**$1,183,386**	**$1,069,448**	**$(23,457)**	**-2%**	**$(113,937)**	**-10%**

Number of approved changes made to the original budget.	3
Number of "re-baselined" budget estimates performed.	3

As you can see, even with the increased timeline and effort required, we were still able to come in 2% under the original budget and almost 10% under the revised budget.

SCHEDULE

Difference in elapsed time of original schedule and final actual schedule.	5 months
Difference in elapsed time of final baseline and final actual schedule.	None

All major deliverables were delivered on time in the first two phases of the project. Phase 3 is the one where there were significant adjustments to the schedule. These changes are documented in the Change section of this document and in detail in the original change control documents.

SCOPE

Section A of this document covers the details of the scope accomplishments. There was considerable design work done between the end of phase 2 and the migration to the new system. The broad business needs were met. We believe we have the best product that we could afford. There was only one major scope adjustment during migration. We had originally planned on using the firewall built into the networking equipment for the K12 system. Unfortunately, the equipment did not perform as expected and we were forced to add the firewall hardware back into the system.

QUALITY

As noted above, our call center volume on the network has actually decreased since the inception of the new network. This indicates a very high quality project.

We believe that all success measures identified in the Business Case that were satisfied or achieved at project completion.

L. LESSONS LEARNED

I think we can say that we are proud to have worked on this project. While we did not get exactly what we hoped, we did make significant progress on improving the state's overall telecommunications infrastructure. With that said, below are some of the things we should do differently and some things we recommend repeating the next time around.

Phase 1

- The PM had limited involvement with original contract or SOW. He was not brought into the loop in time to make a difference. This had an impact by hampering future negotiations. It is extremely important that your PM be intimately involved in any vendor negotiations. After all, they will be the ones responsible to ensure the successful completion of that contract.

- Deliverables were not well defined. Some of this was due to the above item, but, as PM, I must take some of the blame for Phase 2 deliverables. Time pressures forced us to push into that phase as quickly as possible and I did not take enough time to really plan out the deliverables. A WBS session was not performed for Phase 1 and only loosely performed for Phase 2. Sometimes we had "deliverables" with payment points to the vendor on state activities. This was also a part of the reason that we had some change orders (although most of the reason for the changes was due to schedule variance.) One other thing I would attempt to get is a basis for which each deliverable was priced at. This would help me better discuss the value of the services provided. We also already touched on the deliverables issues in phase 3. The vendor needs to be held accountable for their deliverables with some level of penalty or impact to them.

- We should have put limitations on travel. We signed a contract that just said actual costs. However, we were then billed for several $1700 flights. With a week's notice, flights are generally less than $900. I was able to work with the vendor to get a verbal commitment to manage the costs better, but by that time the travel budget was already blown and we ended up over budget for the first phase of the project. I would recommend using the state guidelines as a basis for travel expectations, but would hesitate limiting the vendor to those numbers contractually. Too many times did we find that a hotel that offered state rates one week did not honor them the next. Here is my recommendation on wording for travel expenses.

    - The contract includes reasonable Travel and Living (T&L) expenses. T&L expenses are estimated at $XX,000. T&L expenses will be invoiced at actual cost as they occur. Expense invoices should be detailed at a minimum of the following categories per person: Airfare, Hotel, Meals, Rental Car, and Other.

    - For a typical 4-5 day stay, weekly expenses ran 1500-1600 per person. I would use that number to estimate travel costs for future projects.

- The vendor did not use communication tool as promised in SOW. In both the contract and SOW the vendor's communication tool FEClientNet was touted to be an effective communications tool between client and vendor. In actuality it is a one-way tool, from FE to Client. Anything that the state wanted to upload into it had to be first e-mailed to FE. Even now, at the end of the project, only a handful of items exist on ClientNet, most related to Phase 1 deliverables. The project schedule (MS Project) post on the site is the original one developed at the beginning of the project without a single item showing completed. This leads me to the next point.

- Vendor PM was essentially non-existent. The PM only created the original project plan but had no authority over the project nor managed it to any extent seen by me. None of the items stated in the original SOW regarding project management were delivered. On page 2 of the phase 1 SOW it clearly says "FE will select from proven automated program management tools as needed including:
    - Work breakdown structure, including tasks, deliverables and metrics
    - Gantt charts
    - PERT charts
    - Critical path analysis
    - Personnel and contractor assignments
    - Resource tracking
    - Financial tracking
    - Exception reporting"

  If any of these items were done, they were not shared with us. The state was forced to perform most of these activities themselves investing more time and effort than originally planned. We even had to threaten to get the biweekly status reports on a regular basis. As for financial tracking, I had to create a detailed spreadsheet to track the vendor billing as early on in the project we had major issues with travel expenses including a $2000+ over charge. Again, if FE was doing anything other than invoicing, it was not being shared. The positive aspect of this is that the spreadsheet is now being used as a template by the EPMO.

  Based on the kick-off meeting, contract and SOW, I had expectations of working very closely with the FE PM and feeding him data to fit into a overall project structure. Instead, the state had to do all of those activities and work directly with FE's analysts to create and manage that structure.

- Despite the items above, Phase 1 was overall successful. We were able to formulate a good vision document, present it to key stakeholder requiring only minor modifications, and develop a plan to move forward.

Phase 2

Unfortunately, Phase 2 was a bigger struggle. We believe much of this was due to the change in FE personnel. Deliverable dates started slipping and the quality of deliverables slipped significantly during this phase. Again, state personnel had to pick up a lot of the slack. With all that said, we must say that Phase 2 was a success. You will find details of each RFP below.

- The vendor handled replacement of the primary resource poorly. Based upon review of the contract the vendor actually breached the contract by replacing personnel without the state's written approval (section 6). We only found out about the change 2 days prior to the replacement and even that was not by intent of the company. We were given no say in who was assigned (as the contract clearly gives the state the right). I feel it significantly weakened our trust in the vendor. We know that the vendor had plenty of advance notice about the change. I did not follow-up with the vendor to determine why they did not follow their contractual obligations. Some of the reason was that this replacement really through the state team into a loop as we were totally unprepared for the change.

- The vendor's replacement did not fit needs of the state well. The state needed a leader who understood the high level needs we were trying to fill and could document them into the RFP. We needed someone to drive the process as we were relying on the vendor's expertise in creating similar RFPs. Unfortunately, the replacement (James Anderson) did not fulfill those needs. First, he did not want to travel unless he had to. We originally planned to have the vendor's personnel travel almost weekly to ND. This was what the state was most comfortable with. It was very clear from the start that James did not prefer to travel. In order to start on good relations with the new resource the state chose not to make an issue out of

this. Also, James was much more technical oriented. While this pleased the state technical expert, it wasn't what the project needed.

- This placed a bigger burden on State personnel to make up for loss of expertise. It also was very clear from the beginning that James was not a document expert. State staff had to show him many basic MS Office procedures. Leadership also fell to the state. This was not our expertise area (thus why we hired the vendor) but it still fell to us to lead and drive the project. This was another contributing factor in the change orders and schedule delays. When the vendor brought Tony Herbert onto the project, the state finally felt we had the appropriate resource attached to the project. However, since he was not involved with the planning and early stages of the project, his effectiveness was limited in the RFP development and other later activities. Tony did meet our expectations and provided exceptional service during the Transport RFP evaluations. The combination of Tony and James did a better job of fulfilling the needs of the state.

- Overall vendor recommendation: If the state chooses to use FE again, it should be to provide only specific expertise and the state should know the staff qualifications before contract signing.

RFP Transport:

- Internet Access is not enough of an incentive for companies to commit to significant infrastructure changes in the state. Therefore, I suggest that in the future the state keeps this bid separate from the others using a separate RFP.

- The Internet portion of the bid was extremely successful cutting costs by over half and providing for future additional functionality.

- DCN holds a virtual monopoly for the other services requested. This significantly limits the negotiating power the state can use in developing the contract. One positive thing we were able to negotiate was the ability for ITD staff to perform some configurations on the vendor equipment eliminating a whole work order and processing delay. In addition, while the core network is not what we originally asked for, what we procured provided an economic development opportunity for businesses to procure a similar level service.

RFP Equipment:

- Overall, aside from the Internet portion of the transport RFP, this RFP was the most successful. For the most part, discounts did not significantly change, but we had a good number of responses and were able to choose only 3 vendors who provided overlap in products in almost all requested areas. This gives the state a minimal number of vendors to deal with while protecting it should one of the vendors become unviable. My recommendation would be to closely repeat this RFP when the state rebids the contracts in 3-6 years.

RFP Cellular

- We closed this RFP without award. Even with that decision, most of the evaluation team felt that the information gained was worth the effort and would classify this as a successful endeavor.

- As we learned in the Transport RFP, the voice contract is not big enough to leverage a capital investment for high-speed data into the state. Vendors are basing much of their decisions on current usage. The best way to encourage high-speed data investments is to increase the usage of 1X data services. This could include adding cellular modems for laptops and increased palm type devices such as Blackberry's.

- ❖ It is our recommendation that the next time the voice contract goes out for bid that it be for multiple awards with the major vendors. This allows the agencies to choose the best option that fits their business need rather than focus on lowest cost. Based on what we saw and heard in the process, even though we are the largest contract in North Dakota, it doesn't mean a whole lot to the national vendors. Therefore offering a non-exclusive contract is unlikely to impact price significantly.

- ❖ It is unlikely we will be able to maintain the current pricing structure on the phones for much longer. It was clear that the current vendor, even though they were willing to grandfather in the current low cost phones, would be looking to upgrade those plans to current priced plans for any reason. Should this come to pass, there will be a sizable increase in costs impacting higher education most significantly. Recommend they plan for that in their next biennium budget.

- Each of RFP represents a significant effort for the team and requires a significant effort on the part of the project manager. We would recommend in the future that a project manger be assigned at least 75% of the time for each RFP. In addition, there is little reason to perform these RFPs at the same time while splitting them out allows the team to focus a little better on each area.

- After a year long effort in phases 1 & 2, the project team could have used a bit of a break. Everyone was pretty tired.
- Overall, we were satisfied with the results of Phase 2. Our equipment contracts were on par if not better than the existing ones and we had some redundancy for supply. We significantly lowered our Internet access costs which helped us pay for some of the increased costs of the new network. We were unsurprised by DCN having the only bid for the endpoint services. We were disappointed that we did not get any other bids for the core transport service. This is an area we will want to continue to explore how to get competitive bids.

Phase 3

Some of our phase 3 lessons relate to phase 2 deliverables. While as we noted in Section A, we thought this phase successful, there are a number of lessons we can think about for the next time.

- We would not have signed the contract with DCN if we had an alternative choice involving either dark fiber or light-wave only services.
- There was a lot of negotiation regarding what we were going to get in our core backbone in phase 2. This took a lot longer than expected. This cut into our design time. We would recommend a minimum of 6 months for the design.
- Also impacting the design work was the fact that this was new technology for the vendor as well. Therefore, many times when we asked them design questions we would have to wait for them to research it or do that research ourselves. We anticipate that this will always be the case with this vendor. The state is the one driving the new technology offerings by the vendor. So this would also argue for the extended design period.
- We struggled somewhat with developing a timeline for design. It is a very creative process and is difficult to assign specific time to. However, without some structure design could go on forever. The best compromise is to set an estimated end date, work backwards on what deliverables need to be done, keep the early deliverables high level and draft format, and anticipate schedule risk.
- Buy new equipment to build out new network rather than try to reuse everything. This puts a greater up-front cost on the project but most of the older equipment will either go into storage as spares (reducing future expenditures) or be retired anyway as obsolete. The requirement to reuse equipment on this project had a significant impact to the project and introduced a lot of risk that we probably should not have taken.

  - First it required us to do several preparatory projects just to free equipment up. While some of these projects were good to do anyway and we tried to minimize the impact to the customers, we still had to interrupt service to our customers multiple times (a couple of times for the pre-project and a couple more when we migrated them to the new network.)
  - It made the project plan extremely complex. We were forced to do certain things in a certain order so we could free up certain equipment. Due to delays, we had to change the order of customers three times. This caused us to reexamine how we could free up the right equipment in order to switch things around.
  - It significantly increased the risk of total failure. After about the 3rd or 4th week of migration, there was no way we could back out of the migration cleanly, if at all.
  - The lack of equipment minimized the level of testing that we could do, again increasing the risk of success. The ideal way to make a change like the one we did is to fully install the new system as designed then run a wide range of tests on it. Only then should you begin to migrate from the old system to the new one.
- Continue to increase the level of project management. We used more project management on this project than we had with any other past telecommunications project. We need to continue to build upon this success to overcome or better anticipate issues on the project.
- Don't underestimate the time for site redesign work. Since this project included moving much of our equipment from the Idea One location to the new DCN Fargo facility, we should have planned more time for that transition. (Especially having to reuse a large about of the equipment.) There is too much temptation to reorganize everything while you are there. While that is probably a good idea, you need to make sure you plan for that extra time.
- One major success we had was identifying outages and communicating them to the customers. A lot of time and effort was put into examining in detail who would be impacted by any particular change to the system.
- It was during the preparatory projects phase that we discovered how weak our vendor's project management efforts were. We definitely need to contractually obligate the vendor to perform key project management best practices. When a deliverable was late, the solution was always a "couple of weeks" out. Then they would miss that date and push it out again. We soon lost faith in any estimate the vendor gave. We had people traveling to different sites only to find they couldn't do what they wanted because the site wasn't ready. One of the main examples of this was the Fargo DCN site. Originally, the vendor told us the Fargo site would be ready by the end of May. Due to unrelated delays, it wasn't until mid-June that we started to look at the preparatory work at that site. We learned that the cabinets weren't ready yet. A couple of weeks later we learned that the cabinets were missing the right rails and they had to be ordered. We then begin to install equipment and find out that the fiber cables had not yet been run to those areas. In addition, there was no conditioned power at those racks either. So we bought some fiber cable ourselves to connect some of the equipment and had to use a less then elegant work around for the power issue. Needless to say, it was late July before we reached this point and the power problem was not resolved until mid-September, forcing us to rely on that work around with production traffic on the equipment.
- We also struggled with communications with the vendor at times. Some of the vendor staff had difficult personalities and we struggled with specific technical questions.
- We probably should have monitored the configuration process a little more closely. While the contract clearly laid out the routes, some of them are not logical. Since our vendor is a coalition of providers, sometimes their internal connections are not set up in a completely logical manner. For example, the higher education facility in Bottineau connects to Bismarck rather than Minot. Unfortunately the techs setting up the configurations didn't notice this

issue and had most of the configurations set up as a fully logical quadrant format before we noticed the error. This caused about 2-3 weeks of rework.

- The delays caused by the lack of Nortel parts have both a good and bad lesson to be had. First, it was not likely that we could have met the initial plan ourselves. The timeline was just too tight. On the other hand we could have met a mid-July date and the vendor still wasn't ready.
- We found that the splitting of the PM duties between Brandy and myself worked very well.